

WHAT IS CLAIMED IS:

1. A method of fabricating an article protected by a thermal barrier coating system, comprising the steps of

- providing an article substrate having a substrate surface; thereafter
- producing a pre-oxidized bond coat on the substrate surface, the step of producing the pre-oxidized bond coat including the steps of

 - depositing a bond coat on the substrate surface, the bond coat having a bond coat surface, and
 - controllably oxidizing the bond coat surface to form a pre-oxidized bond coat surface; and thereafter
 - depositing a thermal barrier coating overlying the pre-oxidized bond coat surface, the thermal barrier coating comprising yttria-stabilized zirconia having a yttria content of from about 3 percent by weight to about less than 6 percent by weight of the yttria-stabilized zirconia.

2. The method of claim 1, wherein the step of providing the article substrate includes the step of

- providing the article substrate comprising a nickel-base superalloy.

3. The method of claim 1, wherein the step of providing the article substrate includes the step of

- providing the article substrate comprising a component of a gas turbine engine.

4. The method of claim 1, wherein the step of depositing the bond coat includes the step of

- depositing a diffusion aluminide bond coat.

5. The method of claim 1, wherein the step of depositing the bond coat includes the step of

- depositing a platinum aluminide bond coat.

6. The method of claim 1, wherein the step of controllably oxidizing the bond coat includes the step of

- heating the bond coat in an atmosphere having a partial pressure of oxygen of

from about 10^{-5} mbar to about 10^3 mbar.

7. The method of claim 1, wherein the step of controllably oxidizing the bond coat includes the step of

heating the bond coat in an atmosphere having a partial pressure of oxygen of from about 10^{-5} mbar to about 10^{-2} mbar.

8. The method of claim 1, wherein the step of controllably oxidizing the bond coat includes the step of

heating the bond coat in an atmosphere having a partial pressure of oxygen of about 10^{-4} mbar.

9. The method of claim 1, wherein the step of controllably oxidizing the bond coat includes the step of

heating the bond coat to an oxidizing temperature of from about 1800°F to about 2100°F.

10. The method of claim 1, wherein the step of controllably oxidizing the bond coat includes the step of

heating the bond coat to an oxidizing temperature for a time of from about 1/2 hour to about 3 hours.

11. The method of claim 1, wherein the step of controllably oxidizing the bond coat includes the step of

heating the bond coat to a temperature of from about 2000°F to about 2100°F, for a time of from about 1/2 hour to about 3 hours, and in an atmosphere having a partial pressure of oxygen of about 10^{-4} mbar.

12. The method of claim 1, wherein the steps of depositing the bond coat and controllably oxidizing the bond coat are performed concurrently.

13. The method of claim 1, wherein the step of controllably oxidizing the bond coat is performed after the step of depositing the bond coat.

14. The method of claim 1, wherein the step of depositing the thermal barrier

coating includes the step of
depositing the thermal barrier coating by physical vapor deposition.

15. The method of claim 1, wherein the step of depositing the thermal barrier coating includes the step of
depositing the thermal barrier coating to have the yttria content from about 3.8 to about 4.2 percent by weight of the yttria-stabilized zirconia.

16. A method of fabricating an article protected by a thermal barrier coating system, comprising the steps of

providing an nickel-base superalloy article substrate comprising a component of a gas turbine engine and having a substrate surface; thereafter

depositing a platinum aluminide bond coat on the substrate surface, the bond coat having a bond coat surface; thereafter

controllably oxidizing the bond coat surface to form a pre-oxidized bond coat surface; and thereafter

depositing a thermal barrier coating overlying the pre-oxidized bond coat surface, the thermal barrier coating comprising yttria-stabilized zirconia having a yttria content of from about 3 percent by weight to about less than 6 percent by weight of the yttria-stabilized zirconia.

17. The method of claim 16, wherein the step of controllably oxidizing the bond coat includes the step of

heating the bond coat in an atmosphere having a partial pressure of oxygen of from about 10^{-5} mbar to about 10^3 mbar.

18. The method of claim 16, wherein the step of controllably oxidizing the bond coat includes the step of

heating the bond coat to an oxidizing temperature of from about 1800°F to about 2100°F.

19. The method of claim 16, wherein the step of depositing the thermal barrier coating includes the step of

depositing the thermal barrier coating to have the yttria content from about 3.8 to about 4.2 percent by weight of the yttria-stabilized zirconia.